

**ABSTRACT**

An exemplary embodiment of the invention is an optical communications network transmitting signals on multiple wavelengths. The network includes a first dispersion compensating fiber providing dispersion compensation and dispersion slope compensation. The first dispersion compensating fiber has a first non-zero dispersion coefficient and a first non-zero dispersion slope coefficient. The network also includes a second dispersion compensating fiber in optical communication with the first dispersion compensating fiber. The second dispersion compensating fiber has a second non-zero dispersion coefficient and a second non-zero dispersion slope coefficient. The lengths of first dispersion compensating fiber and second dispersion compensating fiber are selected to compensate dispersion and compensate dispersion slope in a transmission path in optical communication with the first dispersion compensating fiber and the second dispersion compensating fiber. The compensation of dispersion and dispersion slope in the transmission fiber path occurs simultaneously for multiple wavelengths. Alternate embodiments include a method of compensating dispersion in an optical communications network.